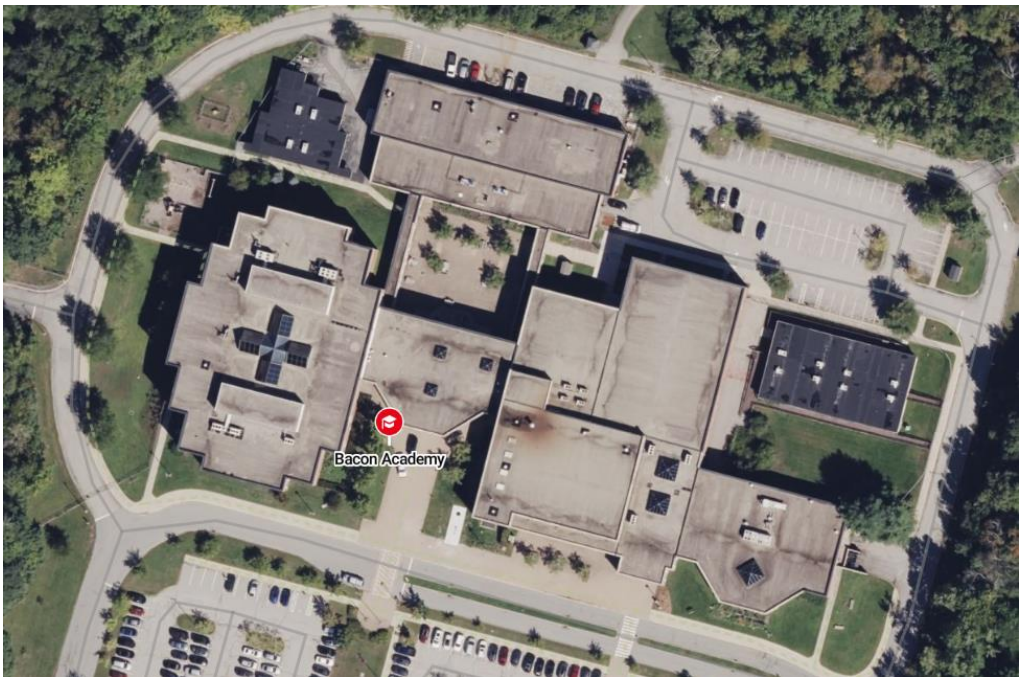
BACON ACADEMY



AIR-CONDITIONING SYSTEM ASSESSMENT/OPTION NARRATIVES

Prepared for:

Colchester Public Schools

February 26, 2025

HFL File No. 2024-2154.01

H.F. LENZ
ENGINEERING
101 Centerpoint Drive, Suite 237
Middletown, CT 06457
Phone: 860-316-2124

BUILDING / GENERAL DOCUMENTATION

AIR-CONDITIONING (AC) ASSESSMENT NARRATIVES

This document consists of an AC System Assessment with recommendations for potential upgrades to the existing AC Systems. The intent of this narrative is to describe general concepts and possible design intent. This document is not intended to fulfill a design development or construction document submission, nor should it be construed as an all-encompassing scope of work.

DESIGN STANDARDS

It is anticipated, based on the preliminary design/construction schedule, the current 2022 Connecticut State Building Codes will be in effect:

The new Connecticut state codes that will be in effect, will be the:

- 2022 Connecticut State Building Code
- 2022 Connecticut State Fire Safety Code
- 2022 Connecticut State Fire Prevention Code

The following model codes are part of the 2022 Connecticut State Building Codes:

- 2021 International Building Code (IBC)
- 2021 International Existing Building Code (IEBC)
- 2021 International Energy Conservation Code (IECC)
- 2021 International Mechanical Code (IMC)
- 2021 International Plumbing Code (IPC)
- 2017 ICC A117.1 Accessible and Usable Building and Facilities
- 2021 International Fire Code (new buildings)
- 2021 NFPA 101 – Life Safety Code (existing buildings)
- 2021 NFPA 1 - Fire Code

BACKGROUND

The Bacon Academy opened in 1993 and is a 192,564 square foot comprehensive public high school building located at 611 Norwich Avenue, Colchester, CT. Bacon Academy provides education for grades nine through twelve in Colchester.

Air conditioning and cooling is present in most classrooms and administrative office areas. Air conditioning and cooling has not been provided, and is desired, for additional portions of the building, including but not limited to:

1. Technical Classrooms
2. Gymnasium and Fitness Room
3. Locker rooms
4. Kitchen areas.

In other areas of the building, original air conditioning equipment is not energy efficient, is near or past its expected useful life, and/or must be replaced or refurbished. This equipment includes the:

1. Cafeteria package rooftop unit
2. Outdoor air conditioning units and evaporator (DX) coils for academic wings A1, A2, A3, and A4
3. Art room B1
4. Auditorium areas G1 and G2.

Certain existing air conditioning equipment is no longer operational because R-22 refrigerant used for equipment included as part of the original building construction is no longer in production and available for reasonable purchase. Also, global refrigeration manufacturers are phasing out HFC refrigerants, such as R-410A, due to their significant global warming potential. While R-410A is a non-flammable type A1 refrigerant, most lower global warming potential replacement refrigerants are mildly flammable, type A2L refrigerants. Because of their flammability, the A2L refrigerants potentially require additional safeguards built into the equipment that uses them. Coordination with local officials will provide potential safeguards and measures to be included within the design.

Colchester's desired goals and scope for this project include:

1. Provide new AC equipment to cool the entire building.
2. Minimize safeguard scope, that may be required for use of the latest mildly flammable A2L refrigerants by locating the majority of refrigerant outside the buildings or within mechanical spaces.
3. Utilize an already awarded Indoor Air Quality (IAQ) grant, to maximize upgrades to existing AC equipment and/or provide AC in desired locations, which currently does not have air-conditioning.

MECHANICAL

MECHANICAL DESIGN NARRATIVE

This document consists of an AC Assessment with recommendations for potential upgrades to the existing AC Systems. The intent of this narrative is to describe general engineering system concepts, design intent, and approximate system capacities. This document is not intended to fulfill a design development or construction document submission, nor should it be construed as an all-encompassing scope of work.

DESIGN STANDARDS

The mechanical work, material, and equipment shall comply with the following codes:

IBC	2021 International Building Code
IMC	2021 International Mechanical Code
IECC	2021 International Energy Conservation Code
NFPA	National Fire Protection Association
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratories
	Applicable County, State and Local Codes
	Rules of State Fire Marshall

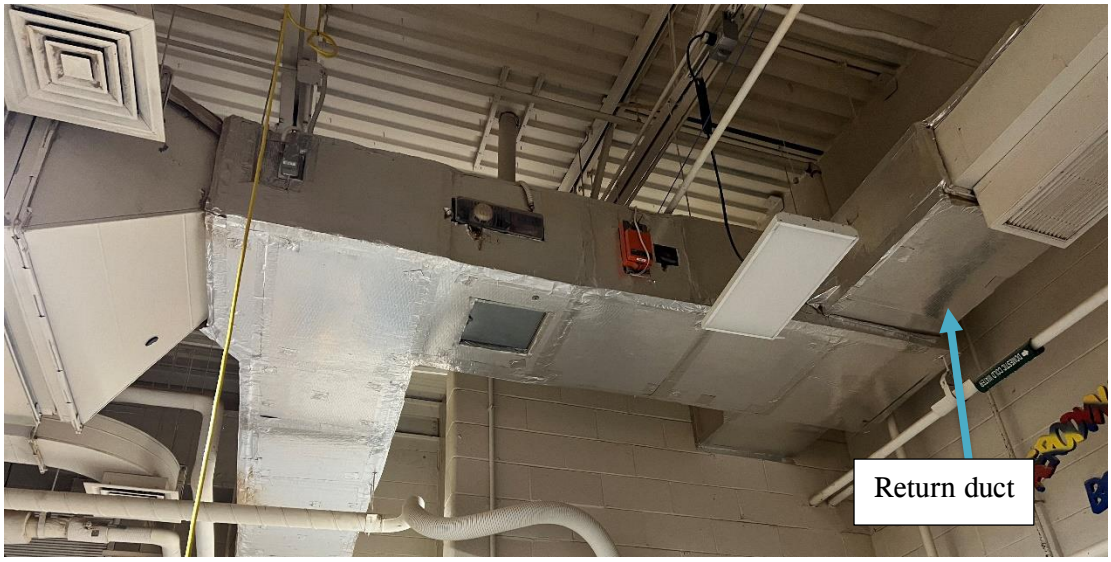
MECHANICAL DESCRIPTION OF EXISTING SYSTEMS

H.F. Lenz conducted site investigations of the building on January 13, 2025. Here is a summary of the key findings:

1. The building uses refrigerant (DX) cooling that uses either R-22 or R-410A refrigerants. Both of these refrigerants have or will become obsolete due to their significant ozone depletion and global warming potentials. Large indoor Air Handling Units (AHUs) contain cooling coils that are connected to refrigerant condensing units on the roof or ground. In general, the indoor AHUs are in fair to good condition, but the outdoor condensing units, which provides that actual ability to cool spaces, are at or beyond their useful life.

2. Although the heating system was not in our scope, we reviewed the system at the Air Handling Unit level, to fully understand the intended design strategy utilized by the existing Air Handling Units. The existing fuel oil boilers create Heating Hot Water (HHW) at 180°F and the HHW pumping system delivers the heat to AHUs and other heating devices throughout the building. At the AHUs, the 100% water from the boilers enters a water-glycol mix/water heat exchanger, and the glycol loop delivers HHW glycol mix to the AHU heating coils. A glycol-water mix minimizes the possibility of coil freeze damage during winter weather.

3. The woodworking shop contains two indoor AHUs that provide 100% Outdoor Air (OA) to compensate for the woodworking equipment exhaust system. These AHUs have return grilles that allow them to heat the space when it is unoccupied. An isolation damper should close when the space is occupied and the AHU brings in 100% OA. The return duct's isolation damper is either broken or not installed.



4. Typical indoor Classroom AHU, which contains both a heating coil and a cooling coil, which utilizes outdated refrigerant.

MECHANICAL SYSTEM UPGRADE OPTIONS

Based on the District having a target budget goal, H.F. Lenz proposes the following mechanical upgrade options in a "Good, Better, Best" format for the Bacon Academy. The budgets are a Rough Order Magnitude (ROM) at this conceptual phase and will be refined through the design process. Bid alternates will be utilized within final design documents in order to provide the district some flexibility based on contractor bids, which will be heavily affect by the material and labor market at the time of bidding.

REPLACE EXISTING DX COOLING IN-KIND - $ 1.5 Million

Scope of Work:

A. For each modular indoor AHU, replace the existing refrigerant cooling coil, and associated outdoor condensing unit, with new equipment.
    1. Academic wings AHUs A1, A2, A3, and A4
    2. Auditorium AHUs G1, G2, and G3.
    3. Gymnasium AHUs D1, and D2. Add cooling.
    4. Art room AHU B1. (Likely a Bid Alternate)
B. Replace cafeteria RTU. (Likely a Bid Alternate)

Pros

1. This option is the most cost-effective way of upgrading the existing cooling systems based on currently installed mechanical cooling methods.
2. Most cost-effective options allow for the most square footage of building space to be upgraded, providing the most thermal comfort possible with available budget dollars.
3. Due to more efficient equipment, electric scope of work is minimized, thus providing more spending dollars for mechanical cooling.
4. Existing cooling only condensing units, upgraded in the philosophy, to heat pumps, would provide a by-product of additional heating, thus potentially minimizing the heating load placed on the boiler system.

Cons

1. A2L refrigerants, if used, may require inclusion of safeguards, based on coordination with authorities having jurisdiction, which would be completed during the design phase.

REPLACE EXISTING DX COOLING WITH AIR-COOLED CHILLERS - $ 1.5 Million

Scope of Work:

A. For each modular indoor AHU, replace the existing refrigerant cooling coil, and associated outdoor condensing unit, with new chilled water equipment.
    1. Academic wings AHUs A1, A2, A3, and A4
    2. Gymnasium AHUs D1, and D2. Add cooling.
B. Replace cafeteria RTU in-kind. (Likely Bid Alternate)

Pros

1. This option eliminates the use of refrigerants in their entirety, which often times is district specific request, or requirement based on 'green' strategies deployed.
2. This option eliminates the use of A2L refrigerants inside the building under normal operation. A2L refrigerants are new to the market, and each manufacturer is selecting their own specific refrigerant, with unknown, new challenges to be worked out at the beginning of their refrigerant life-cycle.

Cons

1. Significantly higher cost than in-kind replacements.
2. Square footage upgrades minimized, thus minimizing the spending power of the awarded grant.
3. This option assumes existing roof supports can be reused to support air-cooled chillers with minimal improvements. Project costs may increase through the design phase, if it is determined that supplemental steel is required to support the air-cooled chillers.

REPLACE EXISTING DX COOLING WITH AIR-COOLED CHILLERS AND ENERGY RECOVERY VENTILATORS - $ 1.5 Million

Scope of Work:

A. Replace cafeteria RTU in-kind.
B. For each modular indoor AHU, replace the existing refrigerant cooling coil, and associated outdoor condensing unit, with new chilled water equipment.
    1. Academic wings AHUs A1, A2, A3, and A4
C. For each modular indoor AHU, install a new Energy Recovery Ventilator that recovers heating and cooling from building exhaust air to pre-condition outdoor air. Install on roof, on indoors through OA intake louver. Add ductwork from AHU to ERV.

Pros

1. This option eliminates the use of refrigerants in their entirety, which often times is district specific request, or requirement based on 'green' strategies deployed.
2. This option eliminates the use of A2L refrigerants inside the building under normal operation. A2L refrigerants are new to the market, and each manufacturer is selecting their own specific refrigerant, with unknown, new challenges to be worked out at the beginning of their refrigerant life-cycle.
3. Adding ERVs can save significant energy, especially in heating season.
4. When ERVs are added, the current energy conservation code requires the cooling and heating equipment be downsized to account for the preconditioning by the ERVs. This downsizing will lead to first cost savings that can be applied to the ERV first costs.

Cons

1. Significantly higher cost than in-kind replacements, or air-cooled chillers.
2. Even further reduction of square footage upgrades, thus minimizing the spending power of the awarded grant.
3. This option assumes existing roof supports can be reused to support air-cooled chillers with minimal improvements. Project costs may increase through the design phase, if it is determined that supplemental steel is required to support the air-cooled chillers.

CONSTRUCTION COST ESTIMATE

ITEM: Bacon Academy - Colchester High School
Option A: In-Kind Replacement Dx

JOB NAME: Bacon Academy IAQ
JOB #: 2024-2154.01
DATE: 2/26/2025
ESTIMATOR: HFL
SHEET 1 **OF** 3

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL COST PER UNIT	MATERIAL COST TOTAL	LABOR COST PER UNIT	LABOR COST TOTAL	LINE TOTAL
	DEMOLITION							
1	Remove existing Cafeteria RTU	1	EA	$ 100.00	$ 100	$ 1,600.00	$ 1,600	$ 1,700
2	Remove existing Condensing Units	8	EA	$ 100.00	$ 800	$ 3,200.00	$ 25,600	$ 26,400
3	Remove existing Refrigerant & its Piping	4	EA	$ 500.00	$ 2,000	$ 1,000.00	$ 4,000	$ 6,000
4	Remove CU and RTU Electrical	9	EA	$ 150.00	$ 1,350	$ 750.00	$ 6,750	$ 8,100
5	Remove existing CC in AHU	8	EA	$ 100.00	$ 800	$ 1,200.00	$ 9,600	$ 10,400
6								
7	**NEW WORK**							
8	Cafeteria RTU	1	EA	$ 42,000.00	$ 42,000	$ 3,000.00	$ 3,000	$ 45,000
9	CUs	10	EA	$ 26,500.00	$ 265,000	$ 3,000.00	$ 30,000	$ 295,000
10	Gym AHUs	1	EA	$ 120,000.00	$ 120,000	$ 20,000.00	$ 20,000	$ 140,000
11	CU Refrig Piping/Supports/Insulation	2,400	LF	$ 18.05	$ 43,315	$ 16.68	$ 40,032	$ 83,347
12	Ductwork repair & replacement	11	EA	$ 2,500.00	$ 27,500	$ 2,500.00	$ 27,500	$ 55,000
13	Controls	108	PTS	$ 1,000.00	$ 108,000	$ 500.00	$ 54,000	$ 162,000
14	Elec Power - Conduit, wire, disconnects	10	EA	$ 5,000.00	$ 50,000	$ 5,000.00	$ 50,000	$ 100,000
15	Gas detection equipment - in AHUs/RTU	11	EA	$ 5,000.00	$ 55,000	$ 2,000.00	$ 22,000	$ 77,000
16	Setup/Cx/TAB	11	EA	$ 250.00	$ 2,750	$ 1,200.00	$ 13,200	$ 15,950
17	Misc painting/cutting/patching	10	EA	$ 100.00	$ 1,000	$ 1,000.00	$ 10,000	$ 11,000
18				$ -	$ -	$ -	$ -	$ -
19				$ -	$ -	$ -	$ -	$ -
20				$ -	$ -	$ -	$ -	$ -
21				$ -	$ -	$ -	$ -	$ -
22				$ -	$ -	$ -	$ -	$ -
23				$ -	$ -	$ -	$ -	$ -
24				$ -	$ -	$ -	$ -	$ -
25				$ -	$ -	$ -	$ -	$ -
26				$ -	$ -	$ -	$ -	$ -
27				$ -	$ -	$ -	$ -	$ -
28				$ -	$ -	$ -	$ -	$ -
29				$ -	$ -	$ -	$ -	$ -
30				$ -	$ -	$ -	$ -	$ -
31				$ -	$ -	$ -	$ -	$ -
32	Site Mobilization	1	LOT	$ -	$ -	$ 12,000.00	$ 12,000	$ 12,000
	Subtotal				$ 719,615		$ 329,282	$ 1,048,897
	General Conditions (6%)							$ 62,934
	Overhead and Profit (10%)							$ 111,183
	Insurance and Bonds (5%)							$ 61,151
	Bid Contingency (10%)							$ 128,416
	Escalation (to Mid-Point 5/2025 - 2%)							$ 28,252
	Grand Total							**$ 1,440,833**

CONSTRUCTION COST ESTIMATE

JOB NAME: Bacon Academy IAQ

JOB #: 2024-2154.01

ITEM Bacon Academy - Colchester High School

Option B: Air Cooled Chillers

DATE: 2/26/2025

ESTIMATOR: HFL

SHEET 2 **OF** 3

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL COST PER UNIT	MATERIAL COST TOTAL	LABOR COST PER UNIT	LABOR COST TOTAL	LINE TOTAL
	DEMOLITION							
1	Remove existing Cafeteria RTU		EA	$ 100.00	$ -	$ 1,600.00	$ -	$ -
2	Remove existing Condensing Units	6	EA	$ 100.00	$ 600	$ 3,200.00	$ 19,200	$ 19,800
3	Remove existing Refrigerant & its Piping	4	EA	$ 500.00	$ 2,000	$ 1,000.00	$ 4,000	$ 6,000
4	Remove CU and RTU Electrical	6	EA	$ 150.00	$ 900	$ 750.00	$ 4,500	$ 5,400
5	Remove existing CC in AHU	6	EA	$ 100.00	$ 600	$ 1,200.00	$ 7,200	$ 7,800
6								
7	**NEW WORK**							
8	Cafeteria RTU		EA	$ 35,000.00	$ -	$ 3,000.00	$ -	$ -
9	ACCs - (1) 200 tons A3,A4, A1,A2; (2) 45 ton D1, D2	1	EA	$ 240,900.00	$ 240,900	$ 36,000.00	$ 36,000	$ 276,900
10	AHU Cooling Coils	6	EA	$ 7.00	$ 42	$ 15,000.00	$ 90,000	$ 90,042
11	CHW Piping/Supports/Insulation	1,200	LF	$ 101.00	$ 121,200	$ 70.60	$ 84,720	$ 205,920
12	CHW Pumps & Accessories	4	EA	$ 20,000.00	$ 80,000	$ 12,500.00	$ 50,000	$ 130,000
13	Ductwork repair, replacement	6	EA	$ 2,500.00	$ 15,000	$ 2,500.00	$ 15,000	$ 30,000
14	Controls	72	PTS	$ 1,000.00	$ 72,000	$ 500.00	$ 36,000	$ 108,000
15	Elec Power - Conduit, wire, breakers, disconnects	3	EA	$ 10,000.00	$ 30,000	$ 5,000.00	$ 15,000	$ 45,000
16	Setup/Cx/TAB	3	EA	$ 500.00	$ 1,500	$ 2,200.00	$ 6,600	$ 8,100
17	Structural Support Upgrades	4	EA	$ 15,000.00	$ 60,000	$ 8,000.00	$ 32,000	$ 92,000
18	Misc painting/cutting/patching	4	EA	$ 100.00	$ 400	$ 1,000.00	$ 4,000	$ 4,400
19				$ -	$ -	$ -	$ -	$ -
20				$ -	$ -	$ -	$ -	$ -
21				$ -	$ -	$ -	$ -	$ -
22				$ -	$ -	$ -	$ -	$ -
23				$ -	$ -	$ -	$ -	$ -
24				$ -	$ -	$ -	$ -	$ -
25				$ -	$ -	$ -	$ -	$ -
26				$ -	$ -	$ -	$ -	$ -
27				$ -	$ -	$ -	$ -	$ -
28				$ -	$ -	$ -	$ -	$ -
29				$ -	$ -	$ -	$ -	$ -
30				$ -	$ -	$ -	$ -	$ -
31				$ -	$ -	$ -	$ -	$ -
32	Site Mobilization	1	LOT	$ -	$ -	$ 12,000.00	$ 12,000	$ 12,000
	Subtotal				$ 625,142		$ 416,220	$ 1,041,362
	General Conditions (6%)							$ 62,482
	Overhead and Profit (10%)							$ 110,384
	Insurance and Bonds (5%)							$ 60,711
	Bid Contingency (10%)							$ 127,494
	Escalation (to Mid-Point 5/2025 - 2%)							$ 28,049
	Grand Total							**$ 1,430,482**

CONSTRUCTION COST ESTIMATE

ITEM: Bacon Academy - Colchester High School
Option C: Energy Recovery Ventilators

JOB NAME: Bacon Academy IAQ
JOB #: 2024-2154.01
DATE: 2/26/2025
ESTIMATOR: HFL
SHEET 3 **OF** 3

ITEM	DESCRIPTION	QTY	UNIT	MATERIAL COST PER UNIT	MATERIAL COST TOTAL	LABOR COST PER UNIT	LABOR COST TOTAL	LINE TOTAL
	DEMOLITION							
1	Remove existing Cafeteria RTU	1	EA	$ 100.00	$ 100	$ 1,600.00	$ 1,600	$ 1,700
2	Remove existing Condensing Units	4	EA	$ 100.00	$ 400	$ 3,200.00	$ 12,800	$ 13,200
3	Remove existing Refrigerant & its Piping	4	EA	$ 500.00	$ 2,000	$ 1,000.00	$ 4,000	$ 6,000
4	Remove CU and RTU Electrical	4	EA	$ 150.00	$ 600	$ 750.00	$ 3,000	$ 3,600
5	Remove existing CC in AHU	4	EA	$ 100.00	$ 400	$ 1,200.00	$ 4,800	$ 5,200
6								
7	**NEW WORK**							
8	Cafeteria RTU	1	EA	$ 35,000.00	$ 35,000	$ 3,000.00	$ 3,000	$ 38,000
9	ACCs - (1) 200 tons A3,A4, A1,A2	1	EA	$ 163,500.00	$ 163,500	$ 15,000.00	$ 15,000	$ 178,500
10	AHU Cooling Coils	4	EA	$ 7,000.00	$ 28,000	$ 15,000.00	$ 60,000	$ 88,000
11	ERVs - 5000 CFM	4	EA	$ 15,000.00	$ 60,000	$ 15,000.00	$ 60,000	$ 120,000
12	CHW Piping/Supports/Insulation	800	LF	$ 85.85	$ 68,680	$ 63.54	$ 50,832	$ 119,512
13	CHW Pumps & Accessories	2	EA	$ 20,000.00	$ 40,000	$ 12,500.00	$ 25,000	$ 65,000
14	Ductwork repair & replacement, add for ERV	4	EA	$ 15,000.00	$ 60,000	$ 10,000.00	$ 40,000	$ 100,000
15	Controls	48	PTS	$ 1,000.00	$ 48,000	$ 500.00	$ 24,000	$ 72,000
16	Elec Power - Conduit, wire, breakers, disconnects	1	EA	$ 90,000.00	$ 90,000	$ 36,000.00	$ 36,000	$ 126,000
17	Setup/Cx/TAB	5	EA	$ 500.00	$ 2,500	$ 2,200.00	$ 11,000	$ 13,500
18	Structural Support Upgrades	2	EA	$ 15,000.00	$ 30,000	$ 6,000.00	$ 12,000	$ 42,000
19	ERV Supports - roof curbs or Conc pads	4	EA	$ 3,000.00	$ 12,000	$ 2,000.00	$ 12,000	$ 24,000
20	Misc painting/cutting/patching	4	EA	$ 100.00	$ 400	$ 1,000.00	$ 4,000	$ 4,400
21				$ -	$ -	$ -	$ -	$ -
22				$ -	$ -	$ -	$ -	$ -
23				$ -	$ -	$ -	$ -	$ -
24				$ -	$ -	$ -	$ -	$ -
25				$ -	$ -	$ -	$ -	$ -
26				$ -	$ -	$ -	$ -	$ -
27				$ -	$ -	$ -	$ -	$ -
28				$ -	$ -	$ -	$ -	$ -
29				$ -	$ -	$ -	$ -	$ -
30				$ -	$ -	$ -	$ -	$ -
31				$ -	$ -	$ -	$ -	$ -
32	Site Mobilization	1	LOT	$ -	$ -	$ 12,000.00	$ 12,000	$ 12,000
	Subtotal				$ 641,580		$ 391,032	$ 1,032,612
	General Conditions (6%)							$ 61,957
	Overhead and Profit (10%)							$ 109,457
	Insurance and Bonds (5%)							$ 60,201
	Bid Contingency (10%)							$ 126,423
	Escalation (to Mid-Point 5/2025 - 2%)							$ 27,813
	Grand Total							**$ 1,418,463**